Reconceptualizing change

Path dependency, path plasticity and knowledge combination

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Editorial

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Introduction

While at any given time the results of evolution may be historically unique, the processes by which they are generated are not necessarily historically unique (Witt 2008, 571). Path dependency is a key concept to understand stability, continuity and change in many disciplines. The concept originated in research on the evolution of technology and in the field of historical and institutional economics (Arthur 1989; David 1985; Dosi 1997; North 1990), it expanded and was enhanced by political and social science (Mahoney 2000; Pierson 2000; Beyer 2005) and by historical institutionalism (Thelen/Steinmo 1992). Furthermore in evolutionary economic geography (EEG) path dependency has become recently a core component of the research agenda (e. g. Boschma/Martin 2010; Hassink 2010; Martin/Sunley 2006). According to Essletzbichler (2012, 138) the question of path dependence is probably the most developed in EEG and related to the question how information stored in products, processes and firm routines are replicated over time.

A unified theory of path dependency does not exist actually. However, there are obvious communalities in the general understandings of the concept, despite all the differences in detail among the various disciplinary discourses. Path dependency is used to describe the causalities and dynamics of a specific open-ended evolutionary process whose early sequences in time have major effects on the future development trajectory. In EEG the emphasis is placed on the contingency of spatial development paths and the general principles behind territorial economic change (Schamp 2012, 121). The non-repeatability of conditions and the irreversibility of changes in time shape the singularity of this evolutionary type of processes that is often named as the *non-ergodic* nature. In recent years there is increasing interdisciplinary interest in the more profound understanding of the specific dynamics of this kind of evolutionary process. Particularly the unfolding of the various self-reinforcing mechanisms over time are much better understood which contribute to the stabilization of paths regardless whether or not their outcomes are suboptimal.

Traditionally socio-economic development has been seen as reflecting path-dependent cumulative knowledge dynamics characterized by parallel co-evolution of technological innovation and social institutions that result in new developments being primarily incremental adjustments of existing practices. More radical changes require de-locking the path by breaking it and/or creating a new one, since early decisions narrow down the variety of available options over time and self-reinforcing mechanisms produce lock-in effects that impede basically new developments.

In contrast to this model which represents a fairly predictable and conservative view of socio-economic developments, we argue that paths are not coherent in themselves and there is always a degree of *plasticity* which enables also that innovation with a minor degree of complementarity within the well-established institutional setting of paths may come into being. The focus on plasticity does not deny processes of deliberate path creation or path breaking (Garud/Karnøe 2001) – the perspective is somewhat different. The focal point is on the dynamics within a path and the way actors use the narrowed down or the limited range of choice of a well-established institutional setting in creative ways for the development of innovation without breaking out of the path. Research under such a perspective might contribute to the understanding why some paths have been remaining dynamic in the long run while others became stuck in negative lock-in effects. That is one of the intriguing questions in economic geography.

Especially under the meanwhile widely accepted perspective that countries and regions are facing a global structural change towards knowledge economies and knowledge societies (e. g. Dolfsma/Soete 2006; Foray 2004; OECD 1996; Strambach 2011; UNESCO 2005), exploring *path plasticity* in theoretical and empirical terms is an important issue. It is still fairly unclear how development trajectories of national and regional economic systems are affected and transformed by the changing nature of innovation processes (e. g. Chesbrough, 2006; Cooke 2005; Schmitz/Strambach 2009) and the growing importance of combinatorial knowledge dynamics. The qualitative shift towards more complex and distributed knowledge interaction processes in organizational and spatial terms is a significant feature of the global structural transformation. The growing importance of combinatorial knowledge dynamics (Crevoisier/Jeannerat 2009; Halkier et al. 2012; Strambach 2008, 2013) may undermine cumulative knowledge bases evolved over time in a path dependent way and anchored in specialized institutional settings. Paradoxically, this shift also has the potential to enlarge the scope of *path plasticity* by widening the field within social actors can innovate – at least in theoretical terms. By accepting that path dependent processes are contingent and their outcome is open-ended, these opposing implications give the exploration of *path plasticity* an important policy dimension.

By taking the path plasticity perspective we claim there is a need to investigate in more depth in institutional change and institutional dynamics within paths, as time, institutions and institutional settings in their interdependence at multi-levels have a strong influence on knowledge dynamics. Here we agree with other scholars in the requirements to enhance EEG with a deeper dynamic institutional analysis (Boschma/Frenken 2011; Essletzbichler 2012; Rafiqui 2009; Schamp 2010, 2012). Explicitly exploring path plasticity is an important theoretical, and indeed empirical, prerequisite for understanding the emergence of combinatorial knowledge dynamics. This article will initiate the discussion by reviewing recent discourses of the path dependence paradigm and institutional change in evolutionary economic geography and on the different neo-institutional approaches grounded in social, organizational and political science. The predominantly conceptual discussion of this contribution will function as a starting point for empirical analysis and further theoretical elaborations throughout this special issue.

Path dependency and regional development

Recently path dependency, a concept imported into the field of geography to explain uneven spatial development, gained much more attention and differentiated discussion as a key concept to understand stability, continuity and change in evolutionary economic geography (Martin/Sunley 2006; Boschma/Martin 2007, 2010; Hassink 2010; Martin 2011; Schamp 2010; Strambach 2010). Path dependence theory which originated in research on the evolution of technology, technological standardization, and in the field of historical and institutional economics (Arthur 1989; David 1985; Dosi 1997; North 1990), is at present a widely used concept also in the political and social science (Mahoney 2000; Pierson 2000; Beyer 2005).

To date, there exists no general theory of path dependency, but meanwhile there is a broad consensus that the concept describes a causal process that constitutes a relatively deterministic trajectory whose early phases are indeed of major importance, but which is on the same time contingent and open-ended. The non-ergodicity is the key nature of path dependent processes or systems, which means the non-repeatability of conditions and the irreversibility of changes in time. Hence, the singularity of processes is the defining criteria for path dependency. As Herrmann-Pillath argues (2002) it is a result of the interdependences of internal and external selection processes resulting in an endogenous directional response. In the words of Martin/Sunley (2006, 399) it is the inability of systems to shake free of their history. A path-dependent process or system is one whose outcome evolves as a consequence of the process's or system's own history.

But even the history-matters-type of path dependency does not mean past dependent in a deterministic way, but rather as Boschma/Frenken (2006, 280) underline that previous events affect the probability of future events to occur. In their view that is precisely the point why the current state of affairs cannot be derived from current conditions only. Taking into account time as an essential dimension an important explanation is made by stressing the impact of self-reinforcing mechanisms[1] which lead to lock-in effects and the co-evolution of economic, technological and institutional arenas over time. On the basis of processes of selection, variation and reten-

tion, systems tend to follow a specific trajectory over time due to the operation of self-reinforcing mechanisms such as different forms of increasing returns, sunk costs, learning effects, adaptive expectation, network economies, coordination and complementarity effects (Arthur 1989; David 1993; North 1990). These reinforcing mechanisms are responsible for lock-in effects that even inefficient or suboptimal results may survive and hinder the movement to another more efficient path.

Many of these mechanisms that ensure continuity in both technological and institutional change, have a local dimension in the way they operate. In research on evolutionary economic geography it is argued that path dependence must be seen as a process or effect that is locally contingent or locally emergent and hence to a large extent place-dependent (Martin/Sunley 2006; Boschma/Martin 2007; Martin 2011, 9). Although there are unresolved issues by the application of the concept in economic geography, it is seen as a highly relevant perspective to explain the evolution of the economic landscape.

The analytical perspective of path dependency in EEG is, not exclusively but primarily, the meso-level with the focus on the evolution of cluster or firm populations like new branches as well as the development trajectories of cities and regions at the system level. In empirical research the theory is used to explain regional development of specific industries and their local trajectories or their developments across different locations as a path-dependent process. Prominent examples are the textile and leather industries in the industrial districts of the so-called Third Italy region (Belussi/Sedita 2009) or the automotive industry in the US and Great Britain (Klepper 2007; Boschma/Wenting 2007). In the 1990s the concept was firstly used at the regional level by Grabher (1993) to explain the lack of renewal in old industrial areas. Investigating in the empirical example of the Ruhr Area in Germany, he identifies three different types of negative lock-in effects – a functional, political and cognitive lock-in among the regional actors – which explain the slow adaptation of the regional economy to exogenous changes and changing markets. Later on these lock-in effects were transferred and specified for the regional economy of Baden-Württemberg by Braczyk/Schienstock/Steffensen (1996) to explain the economic crisis of the long-term economic success model of Baden-Württemberg at the start of the 1990s. Besides old industrial regions also the economic evolution of regional growth trajectories like the Silicon Valley (Kenney / von Burg 2001), or of high-tech regions as Boston has been explained in their path-dependent development process mainly by positive lock in effects.

In the center of the empirical investigation are the different types of self-reinforcing mechanism and co-evolutionary processes. The role of local network externalities and local spin-offs are seen as important mechanisms that explain path-dependent developments within an industry. Especially the establishment of networks and co-evolving institutions that are formed alongside new industries or technologies play an important role by providing stability in selection processes over time. Particular attention in regional path dependent developments is given to *Marshall* and *Jacobs'* externalities (Feldman/Kogler 2009), localized learning processes (Malmberg/Maskell 2006) and knowledge spillovers fostered through proximity economies. Empirical evidence has been provided that neither regional diversity nor regional specialization per se fosters long-term regional economic growth. Related variety between local sectors, based on technological relatedness and the mechanism of regional branching identified by *Boschma* and his colleagues (Boschma/Frenken 2011) are important factors which explain why the emergence and evolution of new industries takes place in one region and not in another. It is argued that the degree of related variety in the region affects the extent to which knowledge spillover may occur and contribute to regional renewal and growth. The theoretical reasoning based on the assumption that regional specialization in technologically related sectors which are complementary in terms of competences induces more knowledge spillovers, interactive learning and regional innovation compared to unrelated sectors (Asheim/Boschma/Cooke 2011; Boschma/Frenken 2011; Boschma/Iammarino 2009).

In recent years the scientific debate in evolutionary economic geography elaborates on the weaknesses, limits and unresolved issues of the path dependency paradigm in its application at the regional level. Particularly the lock-in effects are seen as too weak to be a sound theoretical concept. It is often used inductive bottom-up and based mainly on the observation of few regions (Hassink 2010, 450). The lack of sys-

tematic cross-regional and cross-sectoral comparative research is pointed out, as well as the main problem how to conceptualize and unravel a regional path. Especially *Ron Martin* and his colleagues analyzed in depth conceptional and empirical challenges that are closely related with the systemic complexity of regional economies. Here only some more general problems can be mentioned. First of all, multiple path dependency may be found in a region. The scope and degree of the interlinking path effects is considered as a key issue for further research. Path interdependence is emphasized, understood as situations in which the path-dependent trajectories of particular local industries are to some degree mutually reinforcing (Martin/Sunley 2006; Martin 2011). The missing integration of regional culture in regional path dependence, interdependence and new path creation in regional studies, is considered as a weakness only recently by Cooke/Rehfeld (2012). The intersection of regional and corporate culture is in their opinion an important source for dynamics, as some regions deliver an expanding corporate cultural style to other regions and locations worldwide through the power of their multinational actors. Boschma/Frenken (2011, 302) point out generally that the creation and diffusion of routines among firms within and across regions, and the conditions under which such diffusion process leads to the institutionalization of these routines at various spatial scales, is still largely unexplored.

Another subject is the complex and reciprocally reinforcing co-evolution of local economic, technological and socio-institutional arenas that regional path dependency involves. The often missing analytical rigor of these processes is stated (Schamp 2010). The question how institutional variation and institutional change at different spatial scales is interrelated and in turn, how these processes affect developments at the firm and the industry level in a path, is in large parts an open one. Processes and modes of institutional change and institutional dynamics within a well-established technological and institutional path of a territorial setting are still insufficiently understood (Strambach 2010, 406). Additionally path-dependent development in a region may also involve the co-evolution, or reinforcing interaction of local and non-local arenas. Martin (2011, 201) points out that the various intra-industry and inter-industry interdependencies which develop between regions is an almost wholly unexplored topic.

To sum up, despite the transferability of the path dependency paradigm to the field of regional development is still being debated, it is considered as a key concept in EEG. Place dependence is a significant dimension of path dependence grounded mainly in co-evolutionary processes. In EEG it is emphasized that this research strand might contribute in both theoretical and empirical terms to the foundation of the paradigm, particularly through the investigation in the implications of such co-evolution for path dependence. These might contribute to a deeper understanding of how the institutional context conditions at the meso-level enhance or hinder the unfolding of self-reinforcing dynamics and how these impact innovation processes at the micro-level.

Organizational path dependence – the micro-level view

A closer look at the micro-level discourses in organizational theory and studies might offer insights in the interconnectedness of region-specific institutions as an element of the selection environment and institutional change which evolves simultaneously as a part of the micro-behaviour of firms and organizations. In organization and management theory as well, the concept of path dependence has become more prominent recently. Scientific debates in these strands are similar to the ones in economic geography: A more conceptual and rigorous understanding of organizational path dependence is still part of an emerging field (Schreyögg/Sydow, 2011; Sydow/Schreyögg/Koch 2009). By transferring technological path dependence to a theory of organizational path dependence, the research builds on work of David (1985) and Arthur (1989) and the institutional analysis of economic systems (North 1990), a further communality to economic geography.

A main difference however is the explicit weight that is given to the institutional dimension and to more recent insights from the several theoretical neo-institutional approaches in organizational theory. This shall not come as a surprise, given that the ontological focus of organizational theory is the micro-perspective. For a long time the relation between organizations and institutions has been at the heart of organizational studies. Institutional processes are examined which affect organizational structure and performance as well as societal systems, organizational fields and organizational populations. Institutionalism

in organization theory is not an unified strand. In contrast, there are heterogeneous schools of thought and diverse approaches investigating in the institutional argument to the structure and behaviour of organizations as well as in processes of organizational change, persistence and institutionalization.

This subsection has the aim to shed light on the recent scientific debate in organizational studies which elaborates explicitly on a theory of organizational path dependence and lock-in. The need for developing such a theoretical framework is mainly nurtured by two lines of reasoning. Firstly, it derives from the recognized gap that the technologically based path dependence paradigm addresses insufficiently the persistence of organization and the logic and dynamics of internal organizational process leading to a lock-in (Sydow/Schreyögg/Koch 2009, 690). Secondly, it is argued that even though substantial insights are developed in mechanisms producing organizational stability as routines or institutional complementarities and institutional inertia, a clear process theory that explains how the dynamics enfold beyond the stabilization is still missing (Schreyögg/Sydow 2010).

To get a deeper understanding of the dynamic nature of path dependency in and of organizations Sydow et al. (2009) develop a phase model. They divide the process of becoming path dependent in three stages: the preformation phase, the formation phase and the locked-in phase. The argument behind the three stage model is that these phases are governed by different causal regimes and constitute different settings for organizational action and decision-making. For the organizational context distinct differences in all three stages are identified.

The first stage – path origins – are mainly seen as the result of small, random and contingent events (Arthur 1989; David 1985; Pierson 2005) that trigger self-reinforcing paths and have a lasting influence on path dependent selection (Vergne/Durand 2011, 370). Since organizations are social systems, it is argued that historically framed or imprinted contingency and institutional heritage are always in place. For this reason the preformation phase cannot be characterized by completely unrestricted choice. In the organizational context it is claimed that a less randomized modeling of the initial activities is more suitable as triggering events may be bigger events or even managerial strategies (Sydow et al. 2009). Particularly due to routinization, the resource based theory of the firm and the dynamic capability view explain how firms evolve along trajectories over time. But as Vergne/Durand (2011, 366 ff.) underline there is an unclear relationship at the managerial level between path contingency and irreversibility on the one hand and the managerial intentionality on the other. Also Koch (2011) elaborates on the underexplored relationship between organizational path dependence due to cumulatively developed structures that have been adopted in the past stabilized by routines and strategic path inscription. There has been some criticism on a tendency in dynamic capability research to overstate the managerial ability to reconfigure organizational paths. Instead, in organizational contexts from an evolutionary view it is emphasized that organizational members like managers are important sources of intra-organizational selection insofar as they shape or refocus organizational paths (Vergne/Durand 2011, 374 ff.). Simultaneously it is acknowledged that path-dependent processes have a distinct nature compared to determined processes. While the latter follow a prescribed course of events from the beginning, they are contingent and their outcome is open-ended and described as rather unforeseeable consequences of purposeful actions (Sydow et al. 2009; Vergne/Durand 2011).

Also in the second phase – the formation of a path-dependent process – distinct differences to the technological path approach are highlighted. As self-reinforcing mechanisms are the heart of path dependence, scholars advocate that not all of these mechanisms are of the same relevance in organizational contexts. In this stage in particular four mechanisms which start to operate and drive the development further are of major importance: coordination effects, learning effects, complementarity effects as well as adaptive expectations (Schreyögg/Sydow 2011, 324).

Additionally, in the technological path dependence studies the focus on individual decision-making and the presumption of utility driven behavior falls short by disregarding the broader organizational context. It is claimed that these perspectives neglect the specific organizational forces that can contribute to positive feedbacks and indirect effects. Since *new institutionalism* closely associated with the writings of Meyer/Rowan (1977), Zucker (1977), Scott (1983) and later on Powell/DiMaggio (1991), organizations are considered as deeply embedded in

social and political environments and not only the result of resource dependencies or technological demand. Organizational practices and structures are often either reflections of or responses to rules, beliefs, and conventions built into the wider environment (Powell 2007). A theory of organizational path formation has to take into account explicitly the formal and informal structuring of organizations on the basis of institutional settings as organizational culture or institutionalized routines that may cause hidden dynamics.

Consequently one can conclude based on these debates that a main challenge in building a theory of organizational path dependence is the differentiation between the enabling institutional contexts and the reinforcing dynamics. Sydow et al. (2009) point in this direction, they underline the need to elaborate on the clarification of the causal logic of path building processes and the question how contextual conditions enhance or hinder the unfolding of self-reinforcing dynamics and lead subsequently to the constitution of organizational paths. Especially to figure out "(…) the systemic logic of an escalating reinforcement of an action pattern or a path" (Sydow et al. 2009, 698) is considered as the significant difference of a theory of organizational paths compared to other neo-institutional approaches that also focus on contextual shaping forces like institutional inertia, imprinting or complementarities.

Due to the social character of organizational processes and their complex and ambiguous nature, it is argued that the third stage – the lock-in phase – also requires a somewhat modified conception of lock-in. Even though the action patterns become persistently reproduced and the scope of alternative solutions is narrowed down, the range of choice is not determined entirely. Referring to Giddens (1984) it is stated that there are still at least a small number of options to be chosen by reflexive agents (Sydow et al. 2009; Koch 2011).

Another difference is the explicit requirement to integrate inefficiency in an organizational theory of path dependence. Although the lock-in phase is constitutive for the theory, it has been critically stated that it does not answer whether the final stage is efficient or inefficient. As organizational studies and strategic management approaches focusing on both the organization as objective and the process of organizing it is self-evident that the prime interest is not only investigating in the formal logic of these non-linear and non-ergodic processes in itself. In these research strands it is acknowledged that a tapering organizational process and lock-in do not inevitably mean immediate inefficiency, however, the main line of reasoning is based on potential or latent inefficiency (Sydow et al. 2009; Vergne/Durand 2011; Koch 2011; Schreyögg/Sydow 2011). The latter is understood theoretically as the inherent danger for organizations becoming rigid in a way that present and future scopes of action are hampered as well as the capabilities adapting more efficient alternative actions or new measures are reduced.

While these arguments make sense conceptually, both theoretical and empirical limits are obvious and have not been fully explored. First, an unanswered key question is related to the reference base for discussing inefficiency of an organizational path which might differ depending on the analytical level the group, the department or the organization as a whole or even at the industry level. Second, another unclear question concerns the time dimension and the applied time span for an analysis. The potential or latent inefficiency is only generally attributed to future and long-term development. In turn, as it is extremely difficult to extrapolate past experiences into the future, the issues of potential inefficiency remain mainly a subject for ex post evaluation. This is all the more the case as internal selection events and external selection forces in the environment of organizations are closely interacting over time at multi-levels like the industry or different spatial levels deeply acknowledged in the EEG discourse.

To sum up, in organizational studies the perspective of strategic future-oriented management activities make path dependence a subject of high importance (Sydow et al. 2009; Koch 2011; Schreyögg/Sydow 2011; Vergne/Durand 2011). In the recent debate on the theory of organizational paths and lock-in, the focal point is built explicitly on a dynamic process view and specificities in the organizational context. Similar to the debate in economic geography, several open theoretical, methodological and empirical questions are acknowledged. Even though the discourses on organizational respectively regional path dependency are mainly separated in literature, the connection between them is obvious. Both strands are focusing on routines and their stabilization function in the dynamics of

time-space paths. However, routines are placed at different analytical levels. While in the discourse in organizational studies, routines are located at the macro-level as key elements responsible for organizational path dependence over time. In EEG organizational routines represent the micro-level and are important elements used to explain theoretically continuity and change of paths related to entities at the meso-level. By determining the mechanisms of related variety and regional branching, understood as the way in which new routines develop out of technologically related routines, they contribute to regional economic adaptability (Boschma/Frenken 2006, 2011). However, organizational routines themselves are largely treated as black boxes in EEG. Nevertheless, the research findings in organizational studies demonstrate in detail the complexity of purposeful actions and social processes in routine development and change at the micro-level resulting in unintended idiosyncratic outcomes. The exploration of plasticity within established paths may offer a possibility to link conceptually and systematically these different analytical levels. By doing so, it could provide new insights of dynamics within paths of both regional and organizational entities and their connectedness.

Governance, policy and path dependency

A path dependency perspective has also played a significant role in the study of politics, especially in traditions that have looked beyond the minutiae of political tactics and interactions by trying to situate governance and public policy in their wider social context. Prominent exponents of this approach can be found in parts of the so-called *new institutionalism*, with prominent exponents like *James March, Johan P. Olsen* and *Peter Hall*. In their 1984 manifesto "Organizational Factors in Political Life" *March* and *Olsen* insisted that political institutions cannot be reduced to "arenas for contending social forces" because they are also "collections of standard operating procedures and structures that define and defend interests". From this perspective institutions are seen as "political actors in their own right", coherent, autonomous, and capable of moulding political preferences in society at large (March/Olsen 1984, 738 f.). However, exactly this feedback mechanism between political institutions and citizens/society at large still points towards a systemic functionalist conceptualization in which institutions are stable and institutional change is undertheorized.

From the outset *Hall's* historical institutionalism articulated itself in opposition to functionalist and rationalist traditions. In an approach primarily concerned with comparative empirical studies of the role intermediate-level organizations play in policy-making, he presented the most elaborate early statement of its underlying assumptions, emphasizing "the institutional relationships, both formal and conventional, that bind the components of the state together and structure its relations with society" (Hall 1986, 19). By establishing particular relationships between actors, institutions influence "both the degree of power that any one set of actors has over policy outcomes" and "an actor's definition of his own interests" (Hall 1986, 19), and thus historical institutionalists see actors not as rational *maximizers* but rather as path-dependent *satisficers* (Steinmo/Thelen 1992, 7 ff.). By having institutions define the interests of actors, *Hall* runs the same risk as *March/Olsen*, namely to erect structures that recreate their own conditions of existence and hence should evolve along path-dependent lines in perpetuity. From an empirical perspective this problem would seem to be reduced by the co-existence of several institutions that provide dynamic tensions in societies, but then change would still be prompted by random collisions of static structures resulting in sudden and unpredictable change.

However, reflecting the longstanding critique of the path-dependent assumptions within historical institutionalism (e. g. DiMaggio/Powell 1991; Jepperson 1991; Thelen/Steinmo 1992; Peters et al. 2005; Schmidt 2008), more recent writings within historical institutionalism have explicitly addressed the issue of institutional change, and especially the work of *Thelen, Streeck* and *Mahoney* has been influential (Streeck/Thelen 2005; Mahoney/Thelen 2010). The main features of their contribution can be summarized under three headings:

– Establishing the *scope* for incremental change through a general argument that combines cognitive uncertainties (rules have to be interpreted) with the social need to enforce/maintain rules (institutional compliance/persistence cannot be taken for granted);

– Outlining a *typology* of incremental change in institutions, distinguishing between displace-

ment, layering, drift and conversion on the basis the relationship between old and new rules/ institutions;

– Proposing *causal patterns* which link institutional characteristics (veto points, degree of discretion) with different types of change agents and, ultimately, different patterns of change.

While the causal patterns may be more relevant in studies of political processes, it is clear that the new historical institutionalists have managed to create an argument for the possibility – but of course by no means the certainty – of incremental change *within* institutions, based on their basic cognitive features and possibly driven by actors within these institutions. *Thelen* and her colleagues have in other words demonstrated the plausibility of incremental change, albeit perhaps at the expense of underplaying the role of social complexity, i. e. the coexistence of institutions in social settings that are, inevitably, specifically situated in time and place.

Path plasticity, combinatorial knowledge dynamics and gradual change

In many disciplines the rethinking of path dependency is underway. These scientific debates elaborate much deeper on the limits and unresolved issues of the paradigm. The outcomes call into question the polarized conceptionalization of institutional change found in arguments about path dependence as either being incremental, leading to inertia and to negative lock-ins over time or being disruptive, triggered mainly by exogenous events. Such a dichotomous conceptualization does not take into account the multidimensional character of institutions and institutional settings and their multi-scalarity.

By arguing that paths are not coherent in themselves and by taking into account the tension between agency and structure in specific space-time contexts, we propose to investigate in the plasticity of paths (e. g. Strambach/Storz 2008; Strambach 2010). Such a perspective links up with shortcomings acknowledged in recent discourses which point to sources of plasticity without using the term. Firstly, at the level of organizational as well as regional entities, it is argued that even though action patterns are persistently reproduced and alternative solutions are narrowed down, as it is the case in the lock-in stage of a path, the range of choice is not entirely determined (Sydow et al. 2009; Hassink 2010; Martin 2011). There is always a scope for innovative solutions which creative and reflexive agents can use. The action-guiding function and the selection impact of institutions are dependent on the assessment of actors. Institutional ambiguity, a permanent feature even where rules are formalized (Mahoney/Thelen 2010, 11), and the interpretative flexibility of their meaning is an important source for plasticity. Secondly, that leads to another source of path plasticity, that is the cultural-cognitive elements of institutions. By ascribing legitimacy to actions and meanings they are closely connected with divergent perceptions of agents (e. g. Meyer/Rowan 1977; Powell/DiMaggio 1991; Scott 1983). Cultural and cognitive components of institutions are strong forces in internal and external selection processes besides the regulative ones. These may cause hidden dynamics in the course of strategic intentional actions introduced by actors at different analytical levels and affect the stability and change of paths (e. g. Sydow et al. 2009; Cooke/Rehfeld 2012). Accordingly, decisive is how actors perceive and interpret their situations in relation to the constraining and enabling functions of institutions (e. g. Campbell 2011). Summing up, sources of plasticity within paths enable gradual institutional change and allow institutional variations, the attachment of new elements to existing institutions, the slow rise of peripheral meanings to dominant institutions and their conversion by the redeployment of old institutions to new purposes (Streeck/ Thelen 2005).

However, exploring path plasticity is a challenging perspective in both theoretical and empirical terms implying a more systematic integration of the time dimension and the analysis of the co-evolution of institutional trajectories in path dependency. Time, institutions and institutional settings in their interdependence at multilevels have a strong influence on knowledge interactions – the driving force behind innovation (Crevoisier/Jeannerat 2009; Strambach 2008, 2013; Halkier et al. 2012). Particularly from the perspective of the economics and geographies of knowledge there is a need to investigate in more depth the institutional changes within paths.

In the global structural transformation, knowledge and innovation processes have become increasingly complex. In recent years several

approaches in innovation research acknowledge a qualitative shift towards more complex and distributed knowledge interaction processes in both organizational and spatial terms. Labour division in knowledge production to a larger extent between individual and collective actors has been acknowledged. The debate on distributed innovation, on more open innovation environment (Chesbrough 2006; Cooke 2005; von Hippel 2010) and the organizational decomposition of innovation along fragmented global value chains (Schmitz/Strambach 2009) underline the larger variety of knowledge sources used by organizations and firms. Innovation processes with a transversal nature of knowledge interactions appear to gain importance. These are characterized by the combination of originally separated highly specialized knowledge bases located in different (non-)technological, sectoral and regional contexts spread over a variety of actors (Crevoisier/Jeannerat 2009; Halkier et al. 2012; Strambach 2008; Strambach/Klement 2012).

The debate on the impacts of the changing nature of innovation processes and the qualitative shift towards such combinatorial knowledge dynamics is quite controversial. Scholars active in global value chain research noticed the rise of new geographies of innovation (e. g. Altenburg et al. 2008; Lema 2010). It is pointed out that combinatorial knowledge dynamics may undermine the cumulative knowledge bases (e. g. Antonelli 2005; Asheim/Gertler 2005; Malerba/Osegnio 2000) co-evolved with place-specific institutional settings and anchored in specialized regionally knowledge bases of firms, sectors and networks. Other authors however are more sceptical in assessing the scattered empirical evidence like the catching up of industries in emerging countries and the offshoring of knowledge-intensive activities as a far-ranging transition of a new geography of innovation. It is argued that place-dependent cumulative knowledge bases still remain the major important foundation for future knowledge creation and innovation. Given the fact that the debates cannot be depicted at length here, for our matter of concern it is more important to note that the implications of the qualitative shift to combinatorial knowledge are closely connected with the question of the adaptability of economic systems at the firm, sectoral, regional or national level. How development trajectories at the different analytical levels are affected and transformed is fairly unclear. But accepting that path-dependent processes are contingent and their outcome is open-ended, the opposing implications give the exploration of *path plasticity* an important dimension for future research.

At least in theoretical terms the shift has the potential to enlarge the scope of *path plasticity* by widening the field within social actors can innovate. By tapping a wider diversity of knowledge sources outside the cumulative knowledge bases of paths, options are enhanced for knowledge exploration and its transformation into economic value added. However, combinatorial knowledge creation, characterized by the unification of originally separated knowledge bases located in distinct institutional environments, imply coping with many different cognitive, technological, organizational and institutional interfaces which affect the knowledge integration. Barriers in combining and integrating dispersed and distributed knowledge bases are obvious in the organizational and regional path dependency discourses. The related variety approach (Boschma/Frenken 2011) and research using the taxonomy of differentiated knowledge bases of synthetic, analytic and symbolic knowledge (Asheim 2007) underline boundaries caused by different forms of distance, geographical as well as technological, organizational, sectoral and institutional. Organizational studies identify the level of common knowledge, the frequency and variability of the activity and the structure that economizes on communication as important factors which affect knowledge integration (Grant 1996; Kogut/Zander 1992). The wider the span of knowledge being integrated, the more complex appears the creation and management of organizational routines.

All these results indicate that the intersection of institutional contexts impacts on cognitive distance respectively proximity between the actors. Accordingly, institutional overlaps, present in cumulative knowledge creation within paths, facilitate knowledge integration due to shared norms and values which in turn facilitate mutual understanding, learning and the generation of new knowledge (Nooteboom 2010). Correspondingly, a low degree of institutional overlaps – as characteristic of combinatorial knowledge interactions – implies a wider range of variety and a greater extent of cognitive distance in these kinds of knowledge dynamics (Strambach/Klement 2012). This raises the questions: How do actors use the plasticity of preestablished institutional settings of paths for new

purposes in creating combinatorial knowledge? Which kind of organizational forms and institutional changes make it possible to overcome boundaries and to bridge intra- and inter-organizational interfaces in knowledge combination? Investigating in plasticity of established paths provide a focusing device to link conceptually different analytical levels, and may contribute to deeper insights in the dynamics of institutional change which enables to gain advantages from dispersed and distributed knowledge bases.

Implications of a path plasticity perspective: empirical analysis and public policy

This general theoretical argument has important implications when we turn to the analysis of new forms of knowledge dynamics in regional development. A central contention is that in the structural changes towards knowledge economies and the perspective change from innovation towards knowledge dynamics, the exploration of *path plasticity* in theoretical and indeed in empirical terms is an important issue. The changing nature of innovation processes and particularly the growing importance of combinatorial knowledge dynamics, both significant features of this global structural transformation, enlarged the scope for *path plasticity* and widened the field within which social actors can innovate.

Much more than in the past, innovation processes require the integration of highly specialized knowledge bases distributed over heterogeneous actors. However, knowledge cannot be transferred easily either among actors or combined randomly due to its inherent tacit dimension, its context sensitivity and its process character. Combinatorial knowledge creation characterized by crossing territorial, sectoral and organizational interfaces has to overcome several institutional barriers (Crevoisier/Jeannerat 2009; Halkier et al. 2012; Strambach 2008; Strambach/Klement 2012). Path dependence and the co-evolutionary processes of innovation and institutions over time lead to cumulative knowledge bases anchored/embedded in national and regional institutional settings as well as sector and organization specific institutions. At the territorial as well as at the organizational level there are barriers to – and opportunities for – innovation and knowledge dynamics within paths which are only partially understood and not acknowledged in detail within the different strands of innovation literature. Exploring *path plasticity* would seem to be a promising avenue which could contribute to our understanding of the emergence of combinatorial knowledge dynamics within economic development.

Streeck/Thelen (2005) have identified commonly observed patterns of gradual institutional change which allow classifying and comparing cases across diverse empirical settings. Mahoney/Thelen (2010) point out, albeit this inventory the institutional analysis must go beyond the classification for theorizing and locate the sources of change which are not simply exogenous shocks or environmental shifts. Investigating path dependency and path plasticity in relation to combinatorial knowledge dynamics may enhance the understanding of the way in which continuity and change are related within path-dependent developments. Under this perspective there is a need to investigate with a more nuanced approach in institutional change and institutional dynamics within paths, as time, institutions and institutional settings in their multi-scalarity have a strong influence on knowledge dynamics.

These issues are the underlying common themes in the contributions to the current special issue on combinatorial knowledge and new regional development dynamics between path dependency and path plasticity, with articles focusing on the following:

– The new balance of change and continuity in knowledge sharing within the German construction sector, an area of economic activity that relies on extensive combination knowledge related to high/low technologies and manual/technical functions (*Butzin/Rehfeld*): Recent developments have further emphasized the importance of combinatorial knowledge dynamics (life-cycle thinking, cross-trade building teams, closer public-private collaboration), but still the project-based nature of the building trade makes it difficult to establish stable regional clusters and scale-up innovation.

– The emergence of quality fast food restaurants in Paris, combining the fast urban rhythm with consumer aspirations for differentiation through a trendy/good taste atmosphere (*Kebir/Jeannerat*): The article focuses on the articulation between different food-related knowledge dynamics, and the role of actors and territories in the coordination of activities.

– Repositioning of coastal-rural tourist destinations facing increased competition in the international market for tourism experiences (*Halkier/Therkelsen*): The article starts from the current lock-in/path-dependent crisis of the existing business model based on coordination between a large number of small local actors and a highly seasonal nature-based product revolving around the renting of self-catering holiday homes. This is then contrasted with the efforts of public and private actors to bring about innovations that exploit existing resources in new and creative ways, focusing in particular on the role of extra-regional combinatorial forms of knowledge.

– The role of tacit knowledge anchoring in information security services in Bratislava (*Rehák/Hudec/Buček*): The article explores the distinction between large multinational actors and local firms with regard to access to external tacit knowledge, emphasizing the importance for the latter of a well-functioning local labour market, training institutions and intermediary institutions.

– The role of combinatorial knowledge dynamics and the connected institutional and organizational changes for the dynamics within the development path of the automotive industry in Baden-Württemberg (*Strambach/Klement*): The article analyzes how actors overcome the barriers implied by combinatorial knowledge dynamics through the exploration of path plasticity in the established regional institutional setting. Furthermore it illustrates how 'combining knowledges' has the potential to generate variety and diversity of organizational forms and routines that may in a direct or indirect way foster dynamics within an established path.

– Paths of decline and recovery in textile districts in the Netherlands (*Vissers/Dankbaar*): Starting from three city regions hit by the crisis of the European textiles industry, the article traces the different responses to a similar challenge, including the management by public and private actors of decline, and the possible recirculation of knowledge and other assets in the context of new economic activities.

Taken together the theoretical arguments and empirical analyses would seem to underline not only the importance of combinatorial knowledge in new regional development dynamics, but also that the emergence and application of such knowledges depends on the degree to with path plasticities within existing and, indeed, co-existing, socio-economic institutions. The good news here is of course that in contrast to a lock-in / path dependency perspective on regional economic development, change will not have to be brought about through external shocks but may be the result of incremental adjustments and variations. The challenge will then be, as amply illustrated by the articles in this special issue, for private and public actors to be aware of and explore the scope for variation within existing institutions and, in particular, to exploit the potential of combining of knowledge as a means to furthering economic development through inclusion of multiple stakeholders in order to avoid being entrapped in path-dependent normative and cognitive schemes of dominant institutions.

While this may sound like a trivial point, in practice it constitutes a huge challenge for especially public policy-makers because it involves recognizing the importance of forms of knowledge (cultural, cross-sectoral) that have not traditionally been seen as central to the emerging knowledge economy, moving beyond the traditional triple helix and including demand and cultural trends in civil society in socially sustainable innovation processes (Halkier et al. 2012). It also constitutes a challenge because it creates opportunities for creativity and policy-entrepreneurship but at the same time also underlines that some options are more likely to succeed than others, namely those where there is a positive fit between different types of knowledge resources (Olsen 2012; Dahlström/James 2012). And, equally important, it constitutes a challenge to policy-making because it increases the importance of competences and institutions that are able to bridge different types of knowledge, creatively combine different types of learning processes, draw on the resources from different sectors – and have the ability to reach outside the geographical area for which policies are being designed (Strambach/Klement 2012; Halkier et al. 2012). From a policy perspective the implications of recognizing the role of path plasticity and the (historically) increased importance of combinatorial knowledge are in other words mixed: While lock-in can no longer be seen as the inevitable destiny of some lagging regions, finding a way to move on is a challenge that requires creative and tenacious strategic efforts over a period of time that greatly exceeds the average cycle of electoral politics.

Note

1 We are using the term 'mechanism' in the sense of the social science. Social mechanisms are defined as recurring processes which connect specific causes with specific impacts (Mayntz 2002, 24).

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